

#1 1302

PRELIMINARY Health Assessment for

**VANCOUVER WATER STATION NO. 1 CONTAMINATION
VANCOUVER, CLARK COUNTY, WASHINGTON
CERCLIS NO. WAD988519708
DECEMBER 19, 1994**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry**

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THE ATSDR HEALTH ASSESSMENT: A NOTE OF EXPLANATION

Section 104 (i) (7) (A) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, states "...the term 'health assessment' shall include preliminary assessments of potential risks to human health posed by individual sites and facilities, based on such factors as the nature and extent of contamination, the existence of potential pathways of human exposure (including ground or surface water contamination, air emissions, and food chain contamination), the size and potential susceptibility of the community within the likely pathways of exposure, the comparison of expected human exposure levels to the short-term and long-term health effects associated with identified hazardous substances and any available recommended exposure or tolerance limits for such hazardous substances, and the comparison of existing morbidity and mortality data on diseases that may be associated with the observed levels of exposure. The Administrator of ATSDR shall use appropriate data, risks assessments, risk evaluations and studies available from the Administrator of EPA."

In accordance with the CERCLA section cited, ATSDR has conducted this preliminary health assessment on the data in the site summary form. Additional health assessments may be conducted for this site as more information becomes available to ATSDR.

The conclusion and recommendations presented in this Health Assessment are the result of site specific analyses and are not to be cited or quoted for other evaluations or Health Assessments.

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

PRELIMINARY PUBLIC HEALTH ASSESSMENT
VANCOUVER WATER STATION NO. 1 CONTAMINATION
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CERCLIS NO. WAD988519708

Prepared by
Washington State Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the Superfund law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions

of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records and Information
Services Branch, Agency for Toxic Substances and Disease
Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

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LIST OF ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
CREG	Cancer Risk Evaluation Guides
EMEG	Environmental Media Evaluation Guides
EPA	Environmental Protection Agency
MCL	Maximum Contaminant Level
MRL	Minimal Risk Level
RfD	Reference Dose
TRI	Toxic Chemical Release Inventory
Vancouver	City of Vancouver, Public Works Department
VOC	Volatile Organic Compound
WDOH	Washington Department of Health
WS1	Vancouver Water Station No. 1
WS3	Vancouver Water Station No. 3
WS4	Vancouver Water Station No. 4

LIST OF UNITS OF MEASUREMENT

kg	Kilograms
$\mu\text{g/L}$	Micrograms per Liter
mg/kg/day	Milligrams per Kilograms per Day

SUMMARY

Vancouver Water Station No. 1 site (WS1) is a municipal well field located in Vancouver, Clark County, Washington. In March of 1988, the City of Vancouver, Public Works Department began monitoring the municipal water supply for volatile organic compounds in response to the Federal Safe Drinking Water Act Amendments of 1986. Low concentrations of tetrachloroethylene were consistently found in water from WS1 production wells and reservoir. Later in May of 1993, the City of Vancouver, Public Works Department placed five air stripping towers into operation treating groundwater contamination at WS1 to ensure concentrations of tetrachloroethylene in drinking water complied with the Federal Safe Drinking Water Standards.

The site poses no apparent health hazard to users of the WS1 municipal water supply (residents, workers, and students) as a result of past exposure to low concentrations of tetrachloroethylene in drinking water. Groundwater treatment has eliminated the possibility of current and future exposure to tetrachloroethylene by residents, workers, and students who use water supplied from WS1. Past exposure to tetrachloroethylene may have occurred; however, because of volatilization, concentrations are anticipated to have been minimal and unlikely to cause adverse health effects.

It is uncertain whether exposure to tetrachloroethylene had occurred in the past, is presently occurring, or will occur in the future to residents and workers who use water provided through private supply wells. Existing data is insufficient to adequately characterize groundwater contamination, and private supply well surveys are too limited to conclusively identify all nearby private supply wells. To determine whether private supply wells are at risk to groundwater contamination associated with WS1, it is necessary to further characterize groundwater contamination as well as to identify all nearby private supply wells. Should private supply wells be identified at risk, periodic monitoring of these wells should be conducted to be able to assess exposure to tetrachloroethylene and/or other hazardous substances and to predict associated health risks.

After the public was notified of the discovery of volatile organic compounds in the municipal water supply, local citizens expressed their health concerns to the City of Vancouver, Public Works Department. The citizens' primary concern was about the risk of developing cancer from exposure to tetrachloroethylene-contaminated drinking water. A discussion of community health concerns is included in the Public Health Implications section of this Preliminary Public Health Assessment.

The Washington Department of Health and Agency for Toxic Substances and Disease Registry recommend to 1) further characterize the extent and migration of groundwater contamination associated with WS1; 2) conduct a comprehensive private supply well survey within the vicinity of WS1; 3) monitor water quality of private supply wells considered to be at risk from groundwater contamination; 4) notify owners of private supply wells within the vicinity of groundwater contamination of the potential for exposure to contaminated groundwater; and 5) sample and analyze groundwater from any private supply wells that may be installed in the future within the vicinity of groundwater contamination prior to use.

The data and information developed in the WS1 preliminary public health assessment have been evaluated by the ATSDR Health Activities Recommendation Panel (HARP) for follow-up health actions. No actions are recommended at this time.

BACKGROUND

This Preliminary Public Health Assessment for the Vancouver Water Station No. 1 Superfund site (WS1) is prepared by the Washington Department of Health (WDOH) under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. In this document, available environmental and health data are evaluated to determine public health implications posed by the site.

A. Site Description and History

WS1 is located about one-half mile east of Interstate Highway 5 at the southeast corner of East Fourth Plain Boulevard and East Reserve Street (Figure 1 and 2). Consisting of ten production wells, WS1 generates an annual average of 6,000 gallons per minute and has a peak production capacity of 18,000 gallons per minute. WS1 is one of several water stations that supply drinking water to about 108,000 people in the city of Vancouver and surrounding Clark County.

In March of 1988, the City of Vancouver, Public Works Department (Vancouver) began monitoring the municipal water supply for volatile organic compounds (VOCs) in response to the Federal Safe Drinking Water Act Amendments of 1986. Results of the monitoring revealed VOCs in groundwater at Water Station No. 1, 3, and 4. VOCs detected at WS1, 1,1-dichloroethylene, 1,1,1-trichloroethane, tetrachloroethylene, and trichloroethylene, were at concentrations below the Federal Safe Drinking Water Standard Maximum Contaminant Levels (MCLs). Vancouver notified the public of the detection of VOCs in the municipal water supply, focusing primarily on tetrachloroethylene discovered in groundwater at Water Station No. 4 (WS4). As part of this notification effort, WDOH presented information on the health concerns of using tetrachloroethylene-contaminated drinking water (11).

Vancouver requested assistance from the Environmental Protection Agency (EPA) to investigate potential sources of VOCs in the vicinity of WS1 and Water Station No. 3 (WS3). In 1989, Ecology and Environment, Inc. under contract with EPA conducted a multi-phase study to identify potential sources of VOC contamination. Phase I of the study involved the collection of 194 soil-gas samples and 12 groundwater samples to evaluate contaminant concentration patterns adjacent to WS1 and WS3. Because of limited groundwater sampling, definite conclusions regarding the distribution of VOCs in groundwater could not be drawn. However, sampling results suggested that tetrachloroethylene was not widely distributed in groundwater beneath the study area, while trichloroethane appeared to be more widely spread. Three VOCs, tetrachloroethylene, trichloroethylene, and trichloroethane, were consistently detected in soil-gas in the vicinity of WS1. The distribution patterns suggest that the source of trichloroethylene and trichloroethane may be different than the tetrachloroethylene source, and at least one additional potential source exists near WS1.

Phase II of the study focused on characterizing potential tetrachloroethylene sources which had been identified in previous investigations. This involved the collection of 130 soil-gas samples

to determine the extent of tetrachloroethylene contamination east of WS1 along Fourth Plain Boulevard and to identify additional potential sources in the area. No groundwater samples were collected as part of this study. Soil-gas results indicate two separate tetrachloroethylene sources east of WS1, and no potential sources were located to the west (9).

On July 24, 1992, EPA requested ATSDR to provide a health consultation evaluating health concerns associated with the use of tetrachloroethylene-contaminated drinking water. Tetrachloroethylene contamination was detected at WS1 and WS4; combined these two water stations make up about 60 to 75 percent of the total municipal water supply. Water from WS1 and WS4 production wells is pumped to a reservoir for storage before distribution to the public. Since June of 1991, increases in tetrachloroethylene concentrations had been observed at WS1. Results of sampling collected on April 13, 1992 revealed concentrations at 15 microgram per liter ($\mu\text{g/L}$), 12 $\mu\text{g/L}$, and 18 $\mu\text{g/L}$ in production wells 4, 5, and 6 respectively. At the reservoir, water had concentrations ranging from 2 to 3 $\mu\text{g/L}$. The majority of the water stored at the reservoir was supplied from WS1.

Vancouver had scheduled to install five air stripping towers to treat contamination at WS1 by March 1993 and to begin operation in June 1993. It was a concern that tetrachloroethylene concentrations at WS1 might exceed the MCL of 5 $\mu\text{g/L}$ before the installation of the treatment system. EPA action level for providing an alternative water supply was set at a concentration of 69 $\mu\text{g/L}$ for tetrachloroethylene. Based on this information, the ATSDR health consultation concluded that increased risk of cancer to humans would be minimal should short-term exposure occur to tetrachloroethylene concentrations of 69 $\mu\text{g/L}$ in drinking water.

WS1 was proposed for inclusion on the NPL to be investigated under Superfund, June 23, 1993, and later finalized as a NPL site, May 31, 1994. Vancouver completed the installation of the air stripping towers at WS1, bringing the towers on-line in May of 1993. Performance of the towers has been routinely monitored by Vancouver to ensure tetrachloroethylene concentrations in effluent drinking water meet the MCL of 5 $\mu\text{g/L}$.

B. Site Visit

On June 7, 1994, a site visit was conducted by Jack Morris and Trace Warner of WDOH under the guidance of Vancouver's Operations Superintendent and Assistant Operations Manager. A brief overview on the characteristics, activities, and monitoring program for WS1 was provided by the Operations Superintendent and Assistant Operations Manager.

Located at East Fourth Plain Boulevard and East Reserve Street, WS1 is situated among commercial and residential districts. Immediately north along East Fourth Plain Boulevard are many small businesses, such as Burgerville U.S.A., Tires Unlimited, and Royal Rest Mattress. Residential areas extend further north and west toward Interstate Highway 5, as well as directly east and south of the water station.

WS1 appears to be comprised of two distinct parts. The northern portion of the site is actually Waterworks Park surrounding 9 of the 10 production wells, and is open to the public. The southern portion is completely secured by a chain-linked fence. Inside this secured area are the five air stripping towers situated between a small covered reservoir and a water tower. Additionally, there is a larger covered reservoir with one production well located near the south end of the building. The nearest buildings off the site are an apartment complex and private residence about 50 feet south of the southern fenced boundary.

WDOH was informed during the site visit that Vancouver is presently conducting a wellhead protection study in the area to determine potential sources of contamination. This study may also determine the cone of depression influence on local groundwater from production wells serving WS1.

C. Demographics, Land Use, and Natural Resource Use

Approximately 47,190 people live in Vancouver, Washington. The city of Vancouver is characterized by residential neighborhoods, and is bisected by Interstate Highway 5, creating a corridor of light-industrial development. Land use surrounding WS1 is similar to WS4, which is characterized by single and multi-family residences, as well as small commercial businesses. Schools located near WS1 include: Harney Elementary School, Fort Vancouver High School, Hudson's Bay High School, Clark College, State School for the Deaf, and the State School for the Blind.

The population uses groundwater from either public water systems or private supply wells. Production wells of WS1 access groundwater from the Upper Troutdale Formation aquifer at a depth approximately 200 to 250 feet below ground level. In general, the regional groundwater flows north to south/southwest towards the Columbia River. A supply well at the State School for the Blind also served as a small public water system supplying drinking water for approximately 150 school students and employees. In May of 1992, the State School for the Blind reconnected to the municipal water system for their water supply. The State School for the Blind no longer uses the supply well for drinking water or other purposes. The depth of this supply well is about 220 feet; however the aquifer it accesses is not defined in the available investigation reports.

Municipal water systems historically serviced the area minimizing the need for domestic supply wells. Phase I study included an inventory survey to identify private supply wells in areas adjacent to potential sources and within a one-quarter mile radius of WS1 and WS3 (Figure 3). This survey identified a limited number of functional drinking water wells. Five domestic supply wells were identified during the Phase I study. Two domestic supply wells, GW6 and GW11, were constructed at a depth of 200 feet. GW6 is located about one-half mile northwest of WS1 and GW11 about three-quarters of a mile north. Three of the domestic supply wells GW8, GW10, and GW12, ranged in depth from 30 to 65 feet and are located about one-half mile northwest of WS1. Three industrial supply wells GW5, GW7, and GW9 were also identified. These industrial wells ranged in depth from about 200 to 280 feet below ground surface. GW7 is located immediately southwest of the site, and GW5 is about one-quarter of

a mile southwest of WS1. Situated between WS1 and WS3, GW9 is one-half mile northwest of WS1.

As part of WS4 remedial investigations, a survey was conducted identifying 28 existing private supply wells suitable for monitoring. Fourteen of these supply wells were used for domestic purposes. The wells ranged in depth from 11 to 396 feet accessing either the Orchards or Upper Troutdale Formation aquifers. The survey area extended north/northeast of WS4 which is about one-half mile south/southwest of WS1.

D. Health Outcome Data

Health outcome data are health data contained in databases such as cancer, birth defects, and vital statistic records. Using health outcome databases, it may be possible to determine whether the occurrence of certain health outcomes are greater than expected in Clark County, Washington. Following are the health outcome databases available for the state of Washington.

WDOH has a Vital Statistics Department and an Office of Registries. The Vital Statistics Department collects information on the number of deaths, births, fetal deaths, marriages, and divorces for Washington State. Variables included in this database are geographic location (city, county, town), age, sex, race, cause of death, birth weight, gestational age, and birth defects.

The Washington Birth Defects Registry is a registry of children with serious birth defects diagnosed before their first birthdays. The database contains information by major birth defect classification and by demographic factors: county of residence, sex, race, address, and mother's occupation, smoking history, and age. Information is available for the entire state for the years 1986 through 1989.

The Cancer Surveillance System (CSS) for Washington State is kept by the Division of Public Health Sciences of the Fred Hutchinson Cancer Research Center in Seattle. The CSS works under contract to the Surveillance, Epidemiology, and End Results program of the National Cancer Institute. This database is the central repository for all newly diagnosed malignancies (with the exception of nonmelanotic skin cancers) which occur in residents of 13 counties of northwest Washington State. The population covered is almost one million and includes five standard metropolitan statistical areas: the Seattle-Everett area (King and Snohomish counties), Tacoma (Pierce County), Kitsap, Thurston, and Whatcom counties. The population-based cancer surveillance system monitors the incidence and mortality of specific cancers over time. The variables collected in this database are designed to permit the detection of differential risks of cancer by geographic region, age, race, sex, marital status, social security number, occupation, type of cancer, extent of disease, treatment, hospital identification, and other demographic data.

The health outcome data from relevant databases will be evaluated in the Health Outcome Data Evaluation section of this public health assessment.

COMMUNITY HEALTH CONCERNS

In February of 1989, Vancouver notified the public of the presence of VOCs in the municipal water supply, focusing essentially on tetrachloroethylene contamination discovered in production wells at WS4. In response to the announcement Vancouver received 373 phone calls between February 7, 1989 and February 9, 1990. According to Vancouver and WDOH Drinking Water Program, the primary health concern of the community at that time was the risk of cancer from drinking tetrachloroethylene-contaminated water.

The public was officially invited to comment on the draft Preliminary Public Health Assessment for Vancouver Water Station No. 1 Contamination, October 17, 1994 through November 18, 1994. The document was made available for public review at the Fort Vancouver Regional Library in Vancouver, Washington during this time. As of November 23, 1994, DOH had not received any public comments regarding this public health assessment.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

Listed in the Table 1 is the contaminant of concern associated with WS1. The contaminants of concern are selected from sampling data by comparing the maximum contaminant concentrations to comparison values, such as Environmental Media Evaluation Guides (EMEGs), Cancer Risk Evaluation Guides (CREGs), and other relevant health-based guidelines. The selected contaminants of concern are not necessarily contaminants that will cause adverse health effects from exposure, but rather are contaminants to be evaluated further in the Public Health Implications section of this Preliminary Public Health Assessment.

EMEGs are estimated contaminant concentrations at which daily exposure would be unlikely to result in noncarcinogenic health effects. Oral EMEGs for drinking water exposure are calculated from ATSDR Minimal Risk Levels (MRLs), based on a child body weight of 10 kilograms (kg) and a child water consumption rate of 1 liter per day. ATSDR developed MRLs to evaluate health effects of contaminants commonly found at hazardous waste sites. MRLs are estimates of daily exposure to contaminants below which noncarcinogenic adverse health effects are unlikely to occur. If a MRL does not exist for a specific contaminant, a comparison value is calculated from the EPA Reference Dose (RfD). RfDs are also an estimate of daily exposure to a contaminant that is unlikely to cause a noncarcinogenic adverse health effect.

CREGs are estimated contaminant concentrations at which exposure would not likely result in more than 1 excess cancer in 1 million persons exposed for a lifetime of 70 years. CREGs for drinking water exposure are calculated from EPA cancer slope factors, based on an adult body weight of 70 kg and an adult water consumption of 2 liters per day.

Toxic Chemical Release Inventory

To identify possible facilities that could contribute to groundwater contamination near WS1, WDOH searched the Toxic Chemical Release Inventory (TRI) database for all available years, 1987 through 1992. TRI is developed by EPA from information on chemical releases to air, water, or soil, as provided by industries according to law. TRI did not contain records of tetrachloroethylene releases in Vancouver, Clark County, Washington.

A. On-Site Contamination

Groundwater - WS1 Production Wells and Reservoir

During the Phase I study, groundwater samples were collected in August and October 1989 from two production wells Well #1 and #10 at WS1. Concentrations of 1,1-dichloroethylene, 1,1,1-trichloroethane, and chloroform were detected in both production wells. At Well #1, 1,1-dichloroethylene was observed at 2 $\mu\text{g/L}$, 1,1,1-trichloroethane at 6 $\mu\text{g/L}$, and chloroform at 6 $\mu\text{g/L}$. At Well #10, concentrations of 1,1-dichloroethylene were detected at 2 $\mu\text{g/L}$, 1,1,1-trichloroethane at 8 $\mu\text{g/L}$, and chloroform at 8 $\mu\text{g/L}$. Tetrachloroethylene was not detected at either production well.

The monitoring of the municipal water supply at WS1 and WS4, as well as domestic wells near WS4 consistently revealed tetrachloroethylene in regional groundwater, as well as an increase in the detection of tetrachloroethylene in WS1 production wells. However the VOCs previously detected were not consistently found in groundwater samples. Additionally, the recent annual water quality report released by Vancouver for the total municipal water supply confirmed that concentrations of 1,1-dichloroethylene, 1,1,1-trichloroethane, and chloroform were either not detected or well below the MCL.

Since May 21, 1993, WS1 production wells have been pumping groundwater to the air stripping towers for treatment. The treated water is then transferred to the reservoir before distribution to water customers. Vancouver conducts frequent monitoring of tetrachloroethylene in WS1 production wells and reservoir. The monitoring data generated during March 21, 1988 through September 6, 1994 was review for this document. The comparison of tetrachloroethylene concentrations found in production wells and the reservoir before and after air stripping towers were placed on-line to the health comparison value for tetrachloroethylene is presented in Table 1.

TABLE 1
Concentration Range for Tetrachloroethylene in On-Site Groundwater

Water Station 1	Concentration Range (µg/L)	Comparison Value	
		µg/L	Source
Before Air Stripping Towers Were Placed On-Line (March 21, 1988 through May 17, 1993)			
Well #1 through #10	0.04 - 18.0	0.7	CREG
Reservoir	0.6 - 4.5	0.7	CREG
After Air Stripping Towers Were Placed On-Line (May 24, 1993 through September 6, 1994)			
Well #1 through #10	* 0.4 - 30.0	0.7	CREG
Reservoir	* 0.4	0.7	CREG

* Tetrachloroethylene not detected or trace level is recorded as 0.4 $\mu\text{g/L}$.
References - 4, 5, 6, 7

B. Off-Site Contamination

Ground Water - Private Supply Wells

In August and October 1989, groundwater samples were collected from eight private supply wells in the vicinity of WS1 and WS3 (Figure 3). Of these wells, three (GW5, GW7, and GW9) were industrial wells and five (GW6, GW8, GW10, GW11, and GW12) were domestic wells. As shown in Table 2, the detected VOCs do not exceed the health comparison values and are not considered contaminants of concern. This study however, is limited as to the number of samples and sample locations to adequately characterize off-site groundwater contamination influencing WS1. Additional off-site groundwater monitoring would be necessary to better understand the nature and extent of the groundwater contamination at WS1.

TABLE 2
Concentration Range for VOC Contaminants in Off-Site Groundwater

Private Supply Wells	Concentration Range (µg/L)	Comparison Value	
		µg/L	Source
Industrial and Domestic Wells			
Acetone	2.0 - 3.0	1000	Child RMEG
Chloroform	0.3J - 6.0	6.0	CREG
Chloromethane	0.6J	3.0	LTHA
Ethylbenzene	2.0	1000	Child RMEG
Tetrachloroethylene	0.3J	0.7	CREG
1,1,1-Trichloroethane	0.2J - 4.0J	200	LTHA
Xylenes	6.0	2000	Child Inter. EMEG

J - Estimated concentrations: the analyte was analyzed for and positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample.

Reference - 9

C. Quality Assurance and Quality Control

This Preliminary Public Health Assessment relies upon information provided in referenced documents and assumes that adequate quality assurance and quality control measures were followed regarding chain-of-custody, laboratory procedures, and data reporting. The validity of the analyses and conclusions drawn by this Preliminary Public Health Assessment are dependent on the completeness and reliability of the reference information.

D. Physical and Other Hazards

No physical or other hazards are associated with WS1.

PATHWAYS ANALYSES

To determine whether people are exposed to contaminants associated with WS1, environmental and human components of the exposure pathways are evaluated. Pathway analysis consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of exposure, and an exposed population.

Exposure pathways are categorized as completed or potential. Completed exposure pathways contain all five elements and indicate whether exposure to a contaminant has occurred in the past, is currently occurring, or will be likely occur in the future. Potential exposure pathways have at least one of the five elements missing, but could possibly exist. Potential exposure pathways indicate exposure to a contaminant that may have occurred in the past, may be currently occurring, or may occur in the future. An exposure pathway can be eliminated from consideration if at least one of the five elements is missing and will never be present. The following section discusses exposure pathways relevant to WS1. The completed and potential exposure pathways for WS1 are identified in Table 3.

A. Completed Exposure Pathway

Municipal Water Supply Pathway

Past exposure to contaminated groundwater from the municipal water supply represents a completed exposure pathway. In 1988, tetrachloroethylene was discovered in municipal water supply at WS1. Prior to the operation of the air stripping towers, water from the WS1 reservoir containing low concentrations of tetrachloroethylene was likely to have been distributed to water customers. Exposure may have occurred in the past, although the actual duration of exposure is unknown. Since VOC monitoring was not conducted until 1988, it is uncertain when the municipal water supply was impacted by groundwater contamination and at what contaminant concentrations.

Although past exposure of water customers such as residents, workers, and students to specific tetrachloroethylene concentrations is unknown, exposure is anticipated to be lower than concentrations found in the municipal water supply prior to distribution. Volatilization of tetrachloroethylene from water can occur during storage at WS1 reservoir, as well as during transfer through the distribution lines to water customers. Water samples need to have been collected at points of exposure, such as the drinking water tap to determine concentrations at which people could be exposed to.

Performance tests and monitoring data of the air stripping towers confirm that treatment is effective in removing tetrachloroethylene from water at WS1. Weekly monitoring data from May 24, 1993 through September 6, 1994 show that tetrachloroethylene concentrations after treatment are consistently below analytic detection limit or not detectable. Therefore, exposure to contaminated groundwater from the municipal water supply is unlikely to be currently occurring or to occur in the future.

Residents, workers, and students may have been exposed to tetrachloroethylene in the past primarily through ingestion of drinking water and inhalation of water vapors. Inhalation exposure can occur as tetrachloroethylene volatilizes from contaminated water into indoor air during activities such as showering, bathing, and dish washing. Tetrachloroethylene does not readily pass through the skin, therefore dermal contact is not considered a significant route of exposure.

B. Potential Exposure Pathway

Private Supply Well Pathway

Past, present, and future exposure to contaminated groundwater from private supply wells used for industrial and domestic purposes represent a potential exposure pathway. Eight private supply wells had been identified in the vicinity of WS1 and WS3 during the Phase I study. A low tetrachloroethylene concentration of $0.3 \mu\text{g/L}$ was found in one industrial well (GW9) and tetrachloroethylene was not detected in the domestic wells. The private supply wells have not been resampled since 1989, therefore current conditions are not known.

Remedial investigations for WS4 indicate widespread tetrachloroethylene contamination in regional groundwater; however the extent and migration is not well defined. In addition, monitoring data from 1988 through 1992 suggest an increase in tetrachloroethylene concentrations in water from WS1 production wells, and more recent data, 1992 through 1994, indicate that these concentrations are remaining steady. Should groundwater contamination migrate and impact existing private supply wells, exposure may have occurred in the past, may be presently occurring, or may occur in the future to residents and workers.

Residents and workers may be exposed to tetrachloroethylene primarily through ingestion of drinking water and inhalation of water vapors. Inhalation exposure can occur as tetrachloroethylene volatilizes into indoor air as a result of activities such as showering, bathing, or dish washing. Dermal contact is not a significant route of exposure for tetrachloroethylene.

TABLE 3
Completed and Potential Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Completed Exposure Pathway						
Municipal Water Supply	Groundwater	Groundwater (WS1)	Residences, Businesses, and Schools (tap)	Ingestion and Inhalation	Users of WS1 Municipal Water Supply	Past
Potential Exposure Pathway						
Private Supply Wells	Groundwater	Groundwater (Residential and Industrial Supply Wells)	Residences and Industries (tap)	Ingestion and Inhalation	Residents and Workers Using Private Supply Wells	Past Present Future

PUBLIC HEALTH IMPLICATIONS

A. Toxicological Evaluation

Tetrachloroethylene

Past exposure to tetrachloroethylene is likely to have occurred to users of WS1 municipal water supply. Routes of exposure for tetrachloroethylene are through ingestion of drinking water and inhalation of water vapors during activities such as showering and bathing.

In order to assess health effects resulting from tetrachloroethylene exposure, the daily exposure dose that an individual may receive is estimated. Since tetrachloroethylene volatilizes readily, the exposure dose through inhalation is assumed to be equivalent to exposure dose through ingestion. The estimated daily exposure dose is compared to health-based guidelines for the contaminant to evaluate the potential for noncarcinogenic health effects. Noncarcinogenic health-based guidelines available for tetrachloroethylene exposure include an ATSDR Minimal Risk Level (MRL) and EPA Reference Doses (RfD). ATSDR developed an oral MRL for an intermediate exposure duration (15-365 days) of 0.1 milligrams per kilogram of body weight per day (mg/kg/day). EPA derived an oral RfD of 0.01 mg/kg/day for chronic exposure duration of seven years or longer.

Because the actual concentration of tetrachloroethylene that an individual may have been exposed to through the use of WS1 municipal water supply is not known, assumptions are necessary to calculate the estimate daily exposure. It is assumed that an individual may have been exposed to a concentration as high as the maximum concentration of tetrachloroethylene (4.5 $\mu\text{g/L}$) observed in water from WS1 reservoir. Using this concentration, the estimated daily exposure dose calculated for adults and children does not exceed the RfD for chronic exposure or the MRL for intermediate exposure. Therefore, people who use water supplied from WS1 are unlikely to experience adverse noncarcinogenic health effects from short-term or long-term exposure to tetrachloroethylene.

In evaluating carcinogenic health effects, a cancer slope factor is applied with the estimated daily exposure dose for adults to predict the increased risk of an individual in developing cancer over a lifetime of 70 years. Currently, the carcinogenicity assessment for tetrachloroethylene is under review by EPA. Studies suggest that tetrachloroethylene can cause kidney and liver cancer in animals; however it has not been shown to cause cancer in humans. A decision as to whether tetrachloroethylene should be classified B2 (as a probable human carcinogen based on evidence from animal studies and inadequate or not evidence in human, or C (as a possible carcinogen) is pending. The International Agency for Research on Cancer classifies tetrachloroethylene as a possible human carcinogen.

The pending EPA cancer slope factor of $0.052 \text{ (mg/kg/day)}^{-1}$ can be used to indicate potential increased cancer risk from tetrachloroethylene exposure. Based upon this cancer slope factor,

people exposed to the maximum concentration of tetrachloroethylene in water from the WS1 should experience no increased risk of developing cancer over a lifetime (3, 12).

B. Health Outcome Data Evaluation

The primary health concern expressed by the community is whether exposure to tetrachloroethylene-contaminated drinking water will result in cancer. In general, health outcome data can provide information on the health status of the community living near a hazardous waste site. In this case, however, state cancer registries do not contain health outcome data for Clark County, Washington. Therefore, this community concern cannot be addressed through an evaluation of health outcome data.

C. Community Health Concerns Evaluation

Addressed below is the community concern regarding health for WS1.

1. What is the risk of cancer from drinking water contaminated with tetrachloroethylene?

Exposure to low concentrations of tetrachloroethylene in drinking water may have occurred in the past to individuals who used WS1 municipal water supply. Tetrachloroethylene had been evaluated by EPA for evidence of human carcinogenicity in 1987. EPA classified tetrachloroethylene on a continuum between B2 (a probable human carcinogen based on sufficient evidence in animals and inadequate or no evidence in humans) and C (possible human carcinogen); and a cancer slope factor of $0.052 \text{ (mg/kg/day)}^{-1}$ was derived. Studies indicate that tetrachloroethylene can cause liver and kidney cancer in animals, yet it has not been shown to cause cancer in humans. At this time however, the decision is under review by EPA and the cancer slope factor has been withdrawn (3, 12). Unfortunately, without additional carcinogenic data on tetrachloroethylene the risk of cancer from drinking contaminated water cannot be predicted.

Should EPA decide that the pending cancer slope factor for tetrachloroethylene is valid, residents and workers exposed to the maximum concentration of tetrachloroethylene ($4.5 \text{ } \mu\text{g/L}$) observed in water at the WS1 reservoir would experience no increased risk of developing cancer over a lifetime of 70 years.

CONCLUSIONS

WS1 poses no apparent public health hazard. Groundwater treatment has eliminated the possibility of current and future exposure to tetrachloroethylene to water customers such as residents, workers, and students, who use water provided by WS1 municipal water supply. Past exposure to tetrachloroethylene may have occurred, however concentrations are anticipated to have been minimal and unlikely to cause adverse noncarcinogenic or carcinogenic health effects.

It is uncertain whether exposure to tetrachloroethylene had occurred in the past, is presently occurring, or will occur in the future to residents and workers who use water provided through private supply wells. Existing data is insufficient to adequately characterize groundwater contamination, and private supply well surveys are too limited to conclusively identify all nearby private supply wells. To determine whether private supply wells are at risk from groundwater contamination associated with WS1, it is necessary to further characterize groundwater contamination as well as to identify all nearby private supply wells. Should private supply wells be identified at risk, periodic monitoring of these wells should be conducted to be able to assess exposure to tetrachloroethylene and/or other hazardous substances and to predict associated health risks.

RECOMMENDATIONS

Site Characterization Recommendations:

1. Further characterize the extent and migration of groundwater contamination associated with WS1.
2. Conduct a comprehensive private supply well survey within 1-mile radius of WS1.

Cease/Reduce Exposure Recommendations:

1. Private supply wells (residential and industrial) considered to be at risk from groundwater contamination should be periodically monitored to determine whether exposure to tetrachloroethylene and/or other hazardous substances is occurring at levels of health concern. Groundwater monitoring data from these private supply wells should be shared with WDOH and ATSDR for review of public health implications.
2. Inform private supply wells owners within the vicinity of groundwater contamination of the potential for exposure to contaminated groundwater.
3. Analyze groundwater from any private supply wells that may be installed in the future within the vicinity of groundwater contamination prior to residential and industrial use.

Health Activities Recommendation Panel Recommendations:

The data and information developed in the WS1 preliminary public health assessment have been evaluated by the ATSDR Health Activities Recommendation Panel (HARP) for follow-up health actions. No actions are recommended at this time. If data become available suggesting that human exposure to hazardous substances at levels of public health concern is occurring, WDOH and ATSDR will re-evaluate the site for any indicated follow-up health actions.

PUBLIC HEALTH ACTIONS

The Public Health Action (PHAP) for WS1 identifies actions to be taken by ATSDR and/or WDOH subsequent to the completion of this preliminary public health assessment. The purpose of the PHAP is to ensure that this public health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. ATSDR, in cooperation with WDOH, has developed the following public health actions based upon recommendations from the WS1 preliminary public health assessment and HARP.

1. As additional environmental data becomes available, ATSDR and WDOH will re-evaluate the WS1 for necessary follow-up health activities using current environmental data.
2. ATSDR and WDOH will re-evaluate and may expand the PHAP if additional community health concerns information becomes available. This PHAP will be evaluated annually unless information warrants more frequent evaluation.

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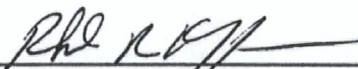
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CERTIFICATION

This Vancouver Water Station No. 1 Contamination Public Health Assessment was prepared by the Washington Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun.



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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment, and concurs with its findings.



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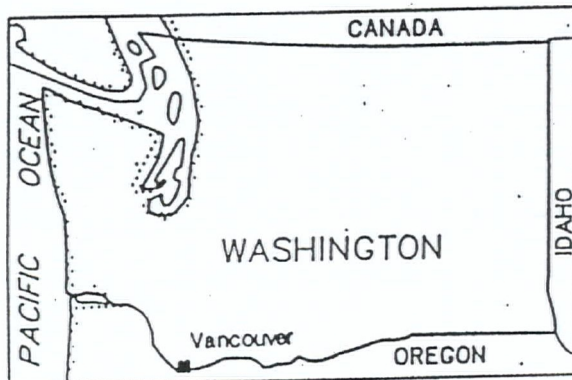
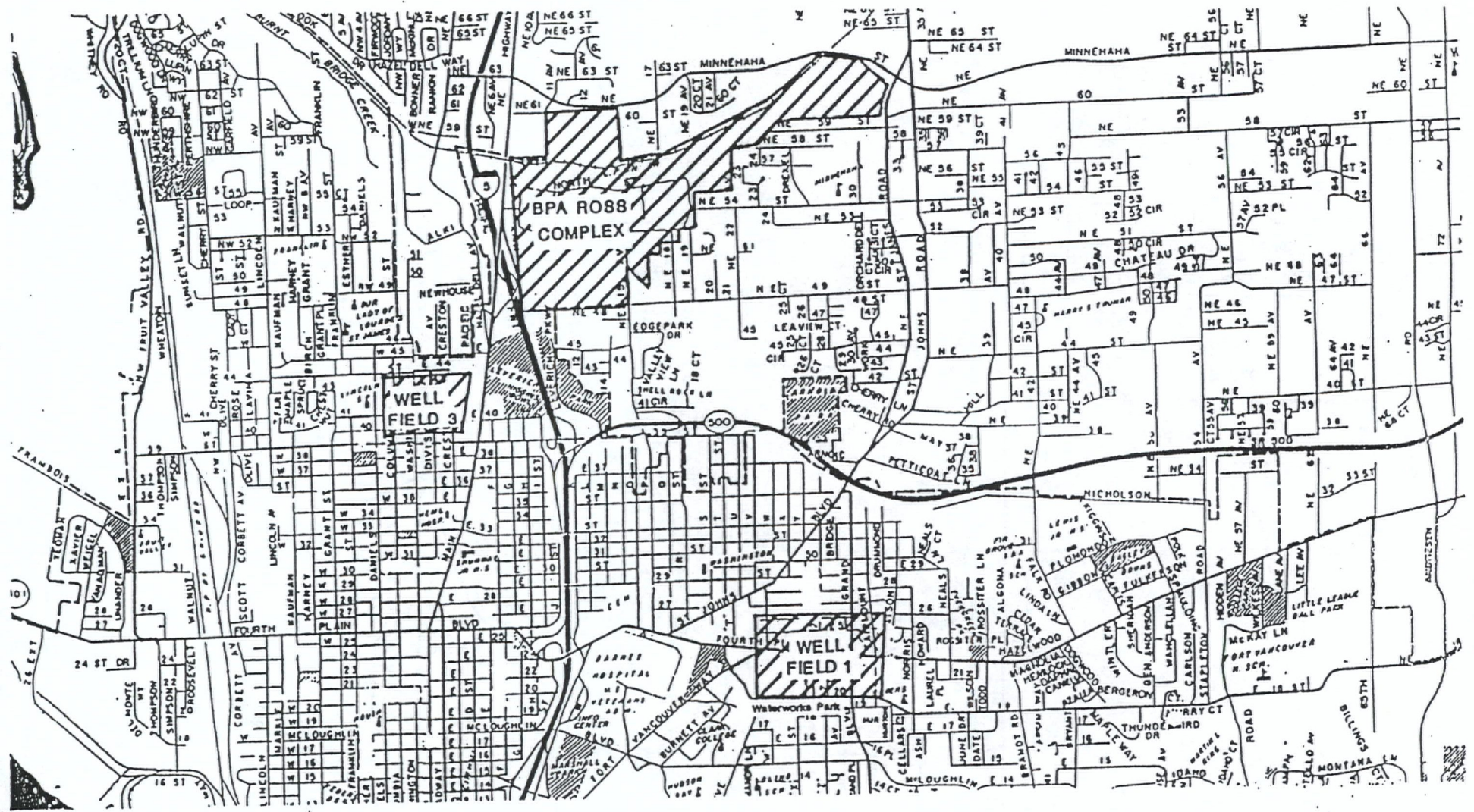
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APPENDIX

Figure 1. Vancouver Water Station No. 1 Location Map

Figure 2. Vancouver Water Station No. 1 Vicinity Map

Figure 3. Groundwater Sample Location Map

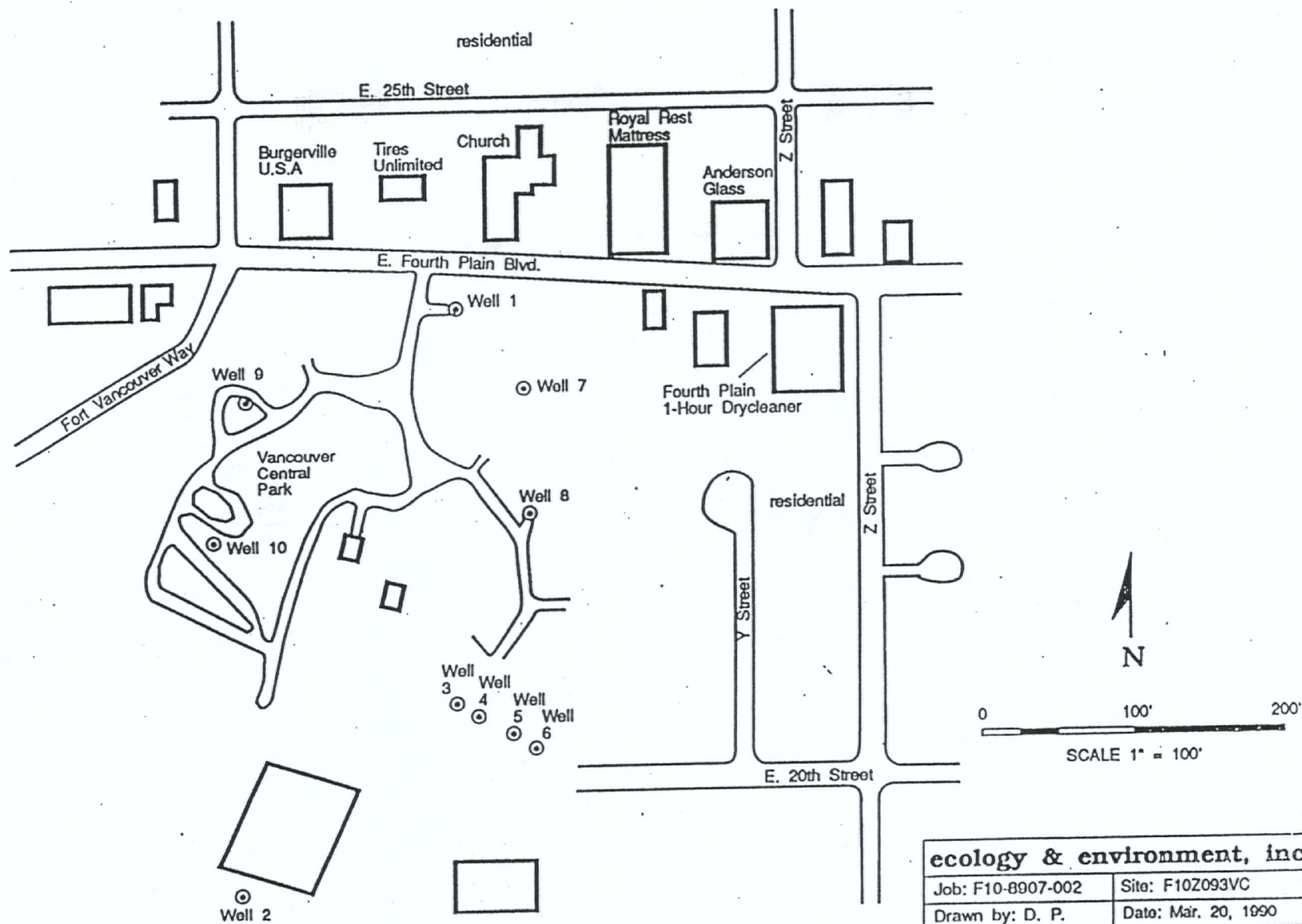


0 1/4 1/2
scale in miles



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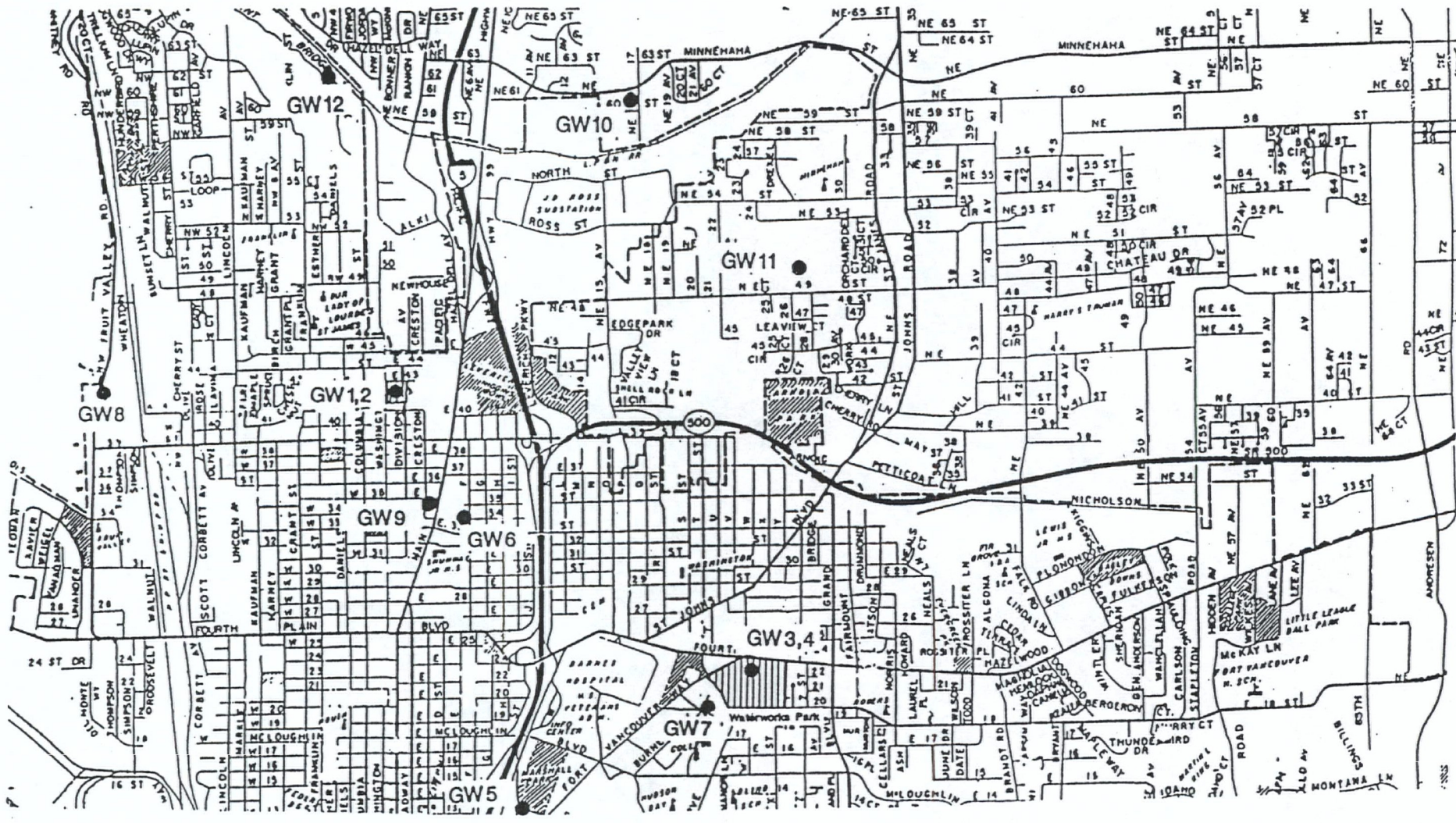
FIGURE 1
LOCATION MAP
VANCOUVER WELL FIELD SPECIAL STUDY
Vancouver, WA



LEGEND

⊙ Well

FIGURE 2
VICINITY MAP
WELL FIELD 1
 VANCOUVER WELL FIELD SPECIAL STUDY
 Vancouver, WA



LEGEND

- Groundwater samples
- ||||| City well fields

0 1/4 1/2
scale in miles



ecology & environment, inc.	
Job: F10-8907-002	Site: F10Z093VC
Drawn by: K.C.	Date: March 28, 1990

FIGURE 3
GROUNDWATER SAMPLE
LOCATION MAP
VANCOUVER WELL FIELD SPECIAL STUDY
Vancouver, WA